Thelephora terrestris and Mycorrhizae of Virginia Pine

BY
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Abstract. Fruiting and mycelial development of *Thelephora terrestris* (Ehr.) Fr. in an inorganic perlite-nutrient solution medium was directly related to the mycorrhizal association with *Pinus virginiana* Mill. seedlings. Preventing photosynthesis of the pine seedlings completely inhibited mycelial growth and sporophore development of the fungus.

Thelephora terrestris (Ehrh.) Fr. frequently has been described as a pest in forest tree nurseries because its heavy growth on stems and needles sometimes can "smother" seedlings. Weir (1921) reported "although the behavior of the fungus is often apparently parasitic, repeated examination of the young pine seedlings enveloped by it has not shown any living part to be invaded." Later Davis *et al.* (1942) stated "Investigators are generally agreed that the fungus hyphae do not penetrate the tissues of the seedlings; any actual harm to the seedling is obviously slight and perhaps the result of effects on organic matter or microflora in the soil." Recently Zak and Marx (1964) discussed previous observations by Zak and Bryan. The latter had traced rhizomorphs from sporophores of *T. terrestris* to mycorrhizae of pines in a nursery. They isolated mycelia from mycorrhizae that they considered identical to those attached to sporophores.

In the past year *Thelephora terrestris*[1] fruited prolifically in our greenhouse on stems of Norway spruce (*Picea abies* (L.) Karst.) seedlings growing in flats of ground sphagnum moss. Mycelium grew over the moist surfaces of the sphagnum and sporophores developed on the outside of the flats from mycelium that extended through cracks. On the opposite side of the greenhouse seedlings of Virginia pine (*Pinus virginiana* Mill.) were growing in 5-inch plastic pots that contained horticultural-grade perlite. These pots were subirrigated three times each week with a mineral nutrient solution and watered daily from the top with distilled water. *T. terrestris* appeared on the surface of the perlite as brown, crusty patches and formed collars around bases of the seedling stems. Sporophores were initiated and matured on the stems as well as detached from them (Fig. 1A). Consequently we began a study to determine the extent of the fungus association with the pine seedlings.

Experimental

Examination of the superficial portions of the fungus revealed that the tan to brown mycelial masses from which sporophores develop, either on seedling stems or free of them, did not extend deep into the substrate. From sporophores on the stem bases we traced small rhizomorphs for 2–4 cm to roots where only individual

[1] Identification verified by Paul L. Lentz, U.S. Dept. Agric. National Fungus Collections, Beltsville, Md.

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hyphae were apparent.

Occasionally a phizomorph was traced directly to a well-developed mycorrhiza (Fig. 1B). When viewed microscopically the hyphae had clamp connections (Fig. 1C). In cross section the Hartig net of an ectotrophic mycorrhiza was clearly evident (Fig. 1D). The mantle was consistently very thin in the many mycorrhizae sectioned.

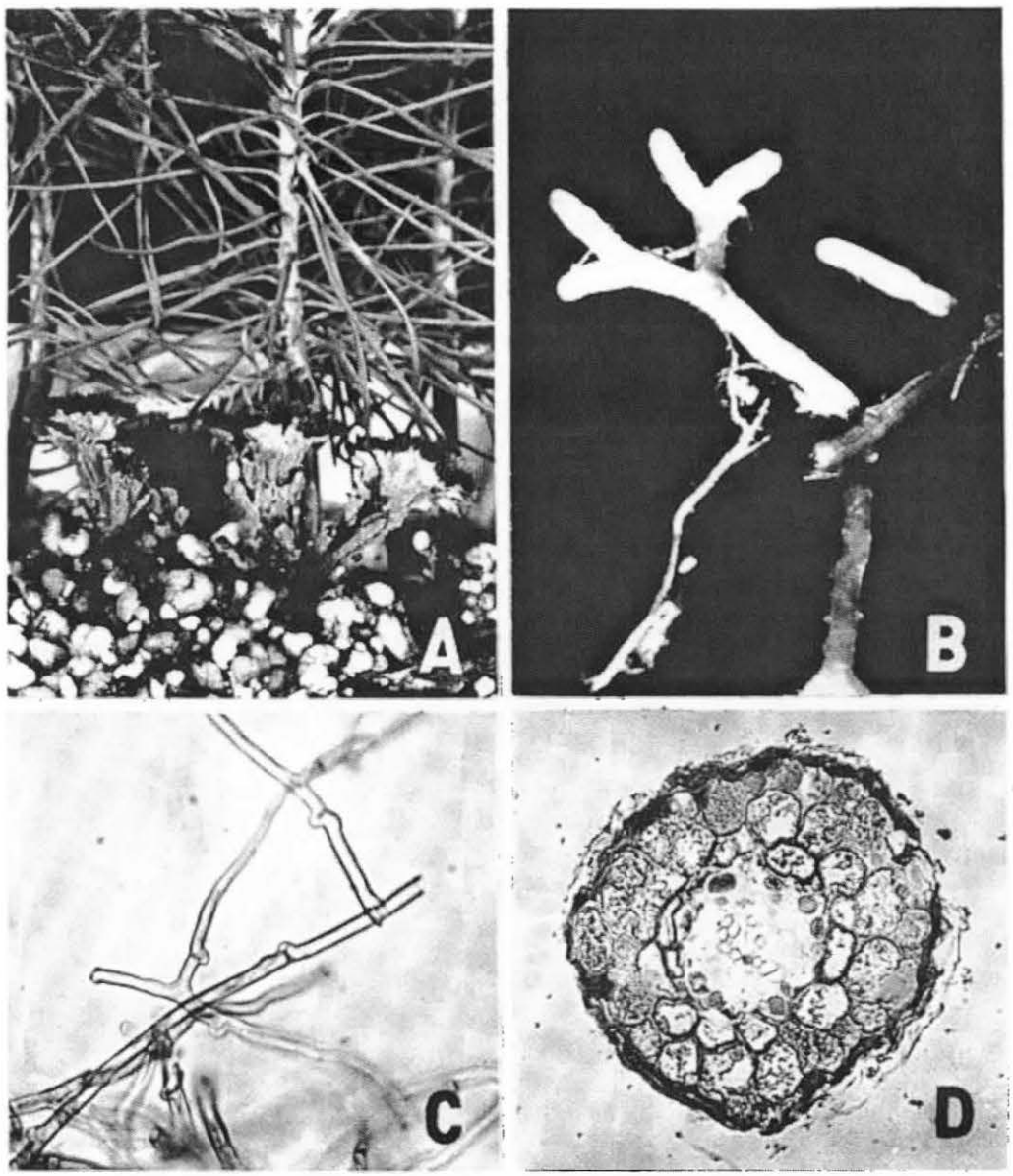

FIGURE 1.A. *Sporophores of* Thelephora terrestris *at base of* Pinus virginiana *seedlings in perlite. B. Rhizomorph from base of a sporophore leading to a mycorrhiza (X10). C. Clamp-connection hyphae of the rhizomorph and mycorrhiza (X430). D. Cross section of the mycorrhiza (X100).*

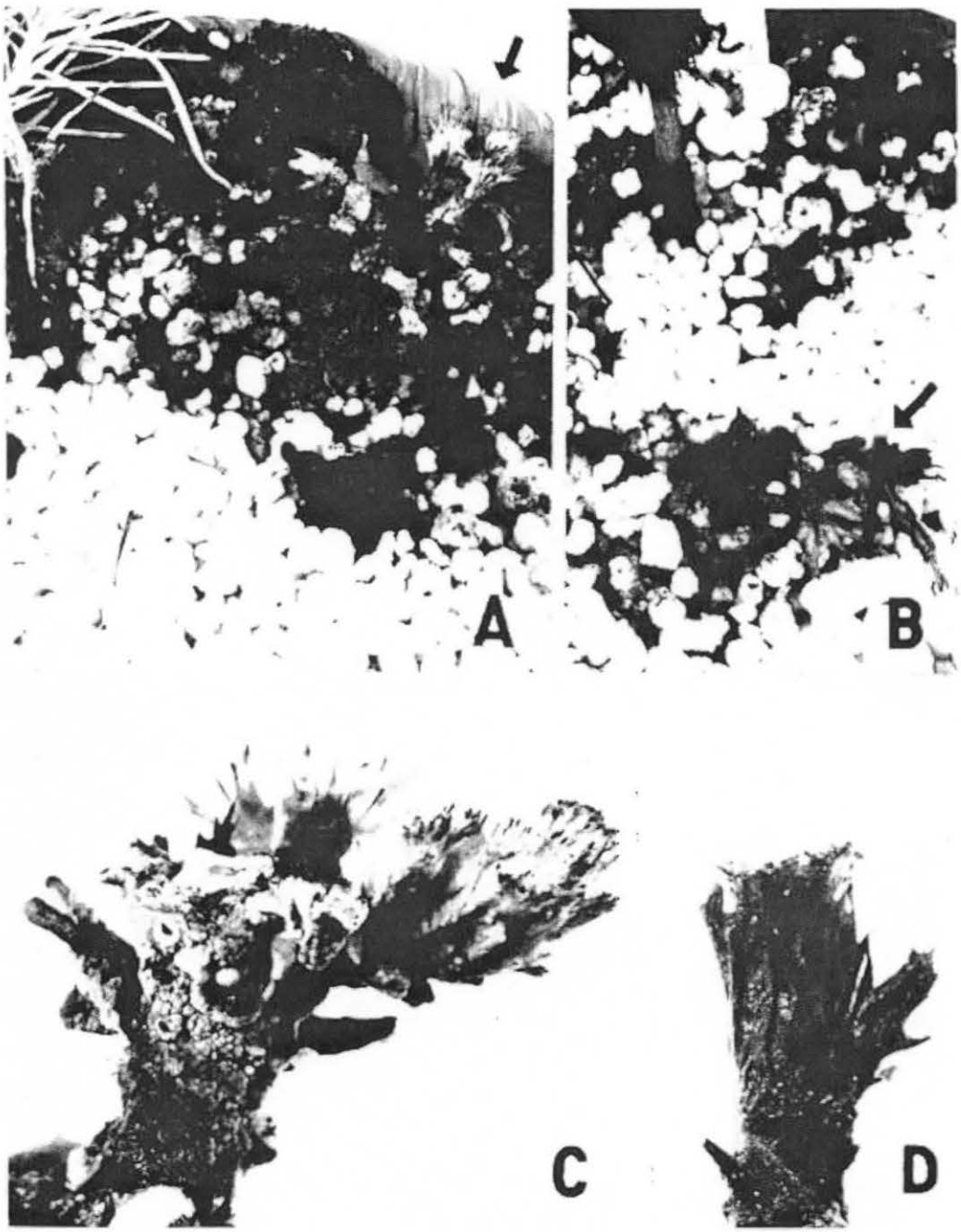

FIGURE 2. *Sporophores of* Thelephora terrestris *in pots with pine seedlings that had: A, the top exposed to light, and B, the top covered with a black cloth bag three weeks previously. C and D. Sporophores on seedling stumps in pots that contained uncovered and covered intact seedlings respectively, as above.*

Newly-formed mycorrhizae were covered with a mantle of white hyphae. With age the mycorrhizae changed successively to cream color to buff to brown. Rhizomorphs displayed the same change in color with increased age.

Using Zak's (1964) techniques of disinfecting mycorrhizae with aqueous solutions of 100 ppm mercuric chloride or 1 percent sodium hypochlorite we were unable to isolate the mycorrhizal fungus in numerous attempts.

To determine whether *Thelephora terrestris* was purely saprophytic or directly dependent on the living roots, thirty pots each containing 3 to 6-week old *Pinus virginiana* seedlings and exhibiting growth of *T. terrestris* on stems and on surfaces of the substrate were treated as follows:

1. Tops of 2 of the 3 seedlings were removed at the cotyledons in 10 pots.
2. Same as 1, except that needles of the intact seedling were covered with a black cloth bag.
3. Tops of all 3 seedlings were removed at the cotyledons in 10 pots.

The pots all were top-watered daily with distilled water and subirrigated with a mineral nutrient solution (Fowells and Krauss 1959) each Monday, Wednesday and Friday.

In group 1 the sporophores continued to develop on and near the intact seedling (Fig. 2A) and on some of the small stumps (Fig. 2C). In each instance where needles of the intact seedlings were exposed to light the fungus continued to thrive. Sporophore and mycelial development ceased immediately, however, in groups 2 and 3. Young sporophores and mycelial masses changed from having a buff to brown, dry appearance to a dark brown, moist, collapsed mass (Fig. 2B), and those on stumps darkened and dried (Fig. 2D).

Four weeks after the plants in group 2 were covered, the black bags were removed from 5 of them. The seedlings were slightly chlorotic, but regained normal coloration in 3 to 4 days. In approximately 14 days many of the mycelial masses on the surface of the perlite had resumed growth. New projections began to develop even on the collapsed sporophore shown in Fig. 2B. Connections between the host plants and surface mycelium and young sporophores either had not been completely severed by the treatment or less likely were quickly re-established. Mycelium and sporophores in the pots that contained covered plants developed no farther up to the time the experiment was terminated.

Preventing photosynthesis by covering the needles or removal of the shoots obviously stopped production of root metabolites essential to the fungus. Mycorrhizal attachments logically served as a means for transmitting the host-derived compound(s) to the fungus (see Melin and Nilsson 1957).

Literature Cited

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